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Original Article

Analysis of Spatio-Temporal Changes in Cropping Pattern: A Case Study of Buldhana District, Maharashtra

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Abstract

Cropping pattern is an important indicator of agricultural transformation, reflecting the combined influence of physical, economic, and technological factors on agricultural land use. The present study analyses the spatio-temporal changes in the cropping pattern of Buldhana district, Maharashtra, during the periods 1995–2000 and 2010–2015 using tehsil-level secondary data. The study focuses on the distribution of major crops through percentage analysis and comparative assessment. The findings reveal a significant decline in the area under traditional cereal crops such as Jowar and Bajara, while Cotton continued to be the dominant commercial crop. The cultivation of pulse crops, particularly Tur, Mung, and Other Pulses, increased considerably, indicating a gradual shift towards diversified and market-oriented agriculture. These changes reflect the impact of changing agricultural practices, irrigation development, and economic factors. The study provides valuable insights for sustainable agricultural planning and efficient land-use management in Buldhana district.

Keywords: *Cropping Pattern, Spatio-temporal Analysis, Agricultural Transformation, Land Use, Crop Diversification.*

Introduction

Agriculture is the backbone of the Indian economy, providing livelihoods to a large rural population and ensuring food security. Over the past few decades, Indian agriculture has undergone significant transformation due to technological advancements, expansion of irrigation, policy reforms, market liberalisation, and climatic variability. These changes have considerably influenced crop selection, land-use practices, and agricultural production, resulting in noticeable changes in cropping patterns across different regions of the country (Birthal et al., 2015; Mahendra Dev, 2012). Cropping pattern refers to the distribution of cultivated land under different crops during an agricultural year and is influenced by factors such as soil, climate, rainfall, irrigation, technology, market demand, and government policies (Rao et al., 2017). Spatio-temporal analysis of cropping patterns helps to understand agricultural transformation, crop diversification, and regional disparities over time. The application of Geographic Information System (GIS) and statistical techniques further enhances the assessment of spatial variations and changing agricultural land use (Roy & Roy, 2010). Buldhana district, located in the Vidarbha region of Maharashtra, is predominantly an agricultural district where cropping patterns have changed considerably due to irrigation development, technological adoption, market forces, and climatic variability. Traditional cereal crops have gradually declined, while commercial and pulse crops have expanded in several tehsils. The present study analyses the spatio-temporal changes in the cropping pattern of Buldhana district using tehsil-level data for the periods 1995–2000 and 2010–2015. It examines the distribution of major crops and evaluates the relationship between cropping patterns and population using statistical techniques to understand the changing agricultural scenario of the district.

Study Area

Buldhana district is situated in the western part of the Vidarbha region of Maharashtra, India. Geographically, it extends between 19°51′ to 21°17′ North latitude and 75°57′ to 76°59′ East longitude. The district encompasses a total geographical area of about 9,661 km² (966,100 hectares) and is administratively divided into 13 tahsils. It shares its northern boundary with Madhya Pradesh, eastern boundary with Akola and Washim districts, southern boundary with Jalna district, and western boundary with Jalgaon district. Owing to its strategic location and diverse physiographic characteristics, Buldhana district plays a significant role in the agricultural economy of the Vidarbha region.

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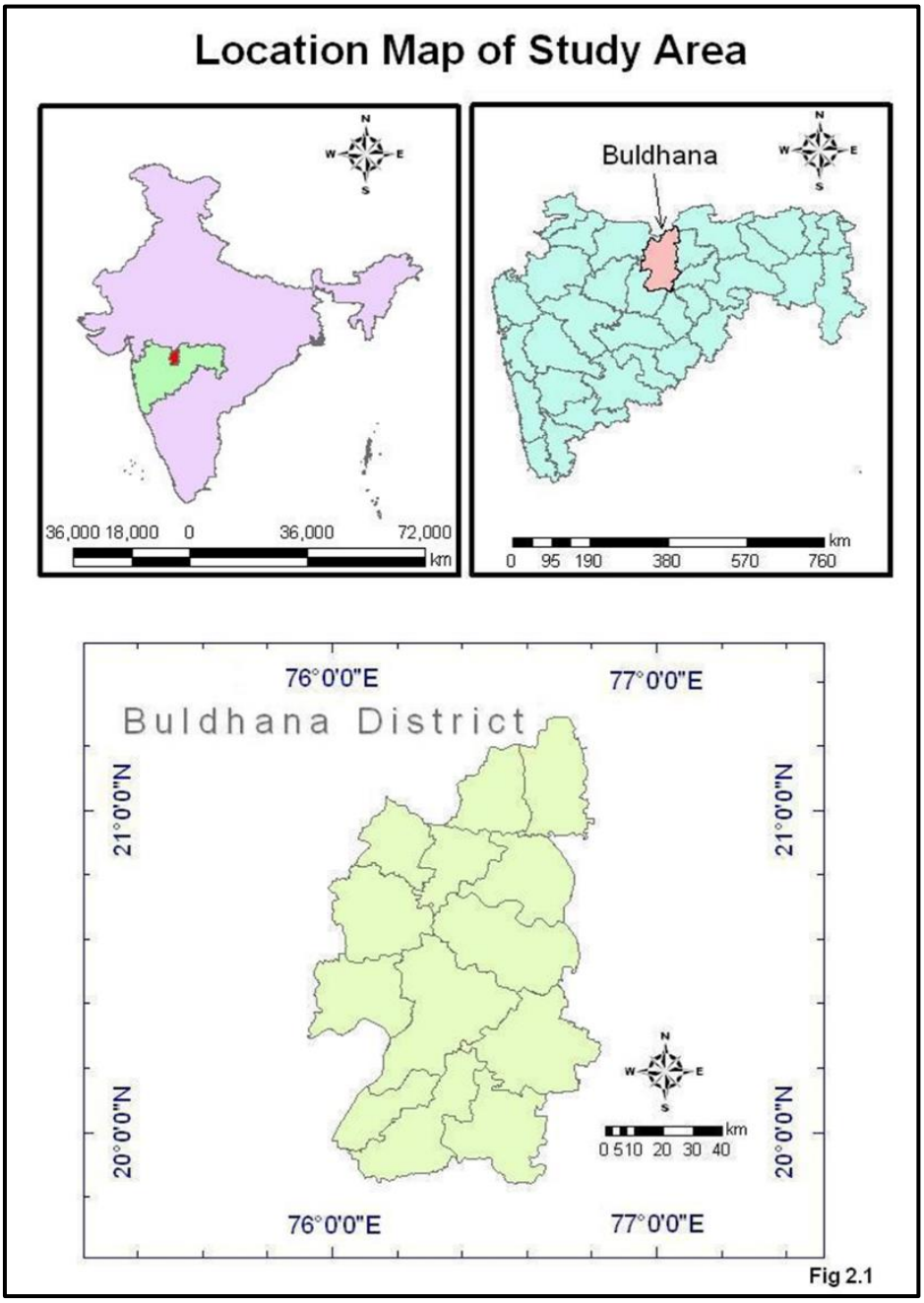

Fig. 1: Study Area Map

Material and Methods

The present study adopts a descriptive and analytical research design to examine the spatio-temporal changes in the cropping pattern of Buldhana district during 1995–2000 and 2010–2015. The study is based entirely on secondary data collected from the District Socio-Economic Review, District Statistical Abstract, Department of Agriculture, Government of Maharashtra, and the Census of India (2001 and 2011).The analysis focuses on the major crops cultivated in the district, including Cotton, Jowar, Wheat, Tur, Mung, Other Pulses, Gram, Maize, Bajara, and Safflower. Crop-wise area was converted into percentages of the gross cropped area using standard cropping pattern formula. Statistical techniques such as percentage analysis, Pearson's correlation coefficient, and Student's t-test were employed to analyse temporal changes and examine the relationship between cropping patterns and population. The statistical significance of the results was tested at the 5% and 1% significance levels. This methodology provides a systematic understanding of the changing cropping pattern in Buldhana district.

Result and Discussion

Spatio-Temporal Changes of Cropping Pattern

Table No. 1 depicts the tehsil-wise cropping pattern of Buldhana district during the periods 1995–2000 and 2010–2015, highlighting significant changes in the area under major crops. The analysis reveals a noticeable shift in agricultural land use from traditional cereal and oilseed crops towards commercial and pulse crops due to changes in rainfall conditions, irrigation facilities, improved agricultural technology, market demand, and government support programmes. Although cotton remained the

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dominant crop throughout the district, the overall cropping pattern became more diversified during the later period.

Cotton occupied the largest proportion of the gross cropped area in both periods, despite a decline from 245,640 ha (30.92%) during 1995–2000 to 217,650 ha (25.82%) during 2010–2015. The crop remained highly concentrated in the tehsils of Shegaon (46.18%), Sangrampur (47.01%), Motala (45.79%), and Malkapur (42.88%), where favourable black cotton soils and suitable climatic conditions encouraged its cultivation. However, cotton cultivation declined considerably in Mehkar, Chikhli, Buldhana, and Lonar, indicating increasing diversification towards pulse crops in these tehsils. Jowar, traditionally the principal food grain crop of the district, recorded a substantial decline over the study period. Its share in the gross cropped area decreased from 212,920 ha (26.80%) to 135,940 ha (16.13%). Although Jowar continued to occupy a relatively larger share in Nandura (25.52%), Deulgaon Raja (21.45%), Malkapur (20.24%), and Motala (19.00%), the overall reduction reflects the gradual replacement of coarse cereals by more remunerative commercial and pulse crops.

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Table No.1: Tehsil-wise Cropping Pattern of Buldhana District (1995-2000 and 2010-15) Area in Hectors & Percentage

Tehsil	Cotton		Jowar		Wheat		Tur		Mung		Other Pulses		Gram		Maize		Bajara		Safflower	
	1995–2000	2010–2015	1995–2000	2010–2015	1995–2000	2010–2015	1995–2000	2010–2015	1995–2000	2010–2015	1995–2000	2010–2015	1995–2000	2010–2015	1995–2000	2010–2015	1995–2000	2010–2015	1995–2000	2010–2015
Jalgaon (Jamod)	16,467 (36.40)	16,712 (34.17)	9,853 (21.78)	6,179 (12.63)	699 (1.55)	2,182 (4.46)	4,139 (9.15)	3,179 (6.50)	1,300 (2.87)	6,349 (12.98)	2,534 (5.60)	5,443 (11.13)	1,004 (2.22)	571 (1.17)	414 (0.92)	2,085 (4.26)	258 (0.57)	108 (0.22)	1,096 (2.42)	184 (0.38)
Sangrampur	23,945 (49.95)	21,478 (47.01)	10,550 (22.01)	5,598 (12.25)	550 (1.15)	1,139 (2.49)	3,115 (6.50)	2,820 (6.17)	1,994 (4.16)	3,318 (7.26)	1,265 (2.64)	4,153 (9.09)	487 (1.02)	615 (1.35)	27 (0.06)	1,996 (4.37)	173 (0.36)	294 (0.64)	1,291 (2.69)	178 (0.39)
Shegaon	23,309 (41.63)	24,056 (46.18)	17,953 (32.06)	9,364 (17.98)	146 (0.26)	844 (1.62)	2,990 (5.34)	2,214 (4.25)	1,463 (2.61)	7,222 (13.86)	1,764 (3.15)	4,524 (8.68)	1,099 (1.96)	271 (0.52)	30 (0.05)	957 (1.84)	1,870 (3.34)	158 (0.30)	1,414 (2.53)	253 (0.49)
Nandura	17,655 (35.86)	17,190 (35.64)	14,788 (30.04)	12,308 (25.52)	387 (0.79)	1,014 (2.10)	3,648 (7.41)	2,442 (5.06)	2,528 (5.14)	3,386 (7.02)	2,979 (6.05)	4,054 (8.41)	651 (1.32)	703 (1.46)	42 (0.09)	1,110 (2.30)	1,023 (2.08)	785 (1.63)	1,897 (3.85)	225 (0.47)
Malkapur	18,642 (39.35)	19,407 (42.88)	15,806 (33.36)	9,161 (20.24)	489 (1.03)	850 (1.88)	2,071 (4.37)	2,189 (4.84)	843 (1.78)	2,693 (5.95)	1,312 (2.77)	4,099 (9.06)	890 (1.88)	365 (0.81)	47 (0.10)	2,033 (4.49)	631 (1.33)	343 (0.76)	802 (1.69)	194 (0.43)
Motala	17,736 (30.67)	27,229 (45.79)	18,637 (32.23)	11,300 (19.00)	717 (1.24)	3,110 (5.23)	3,148 (5.44)	3,038 (5.11)	1,679 (2.90)	3,303 (5.55)	4,964 (8.59)	5,197 (8.74)	603 (1.04)	186 (0.31)	73 (0.13)	1,773 (2.98)	1,742 (3.01)	180 (0.30)	1,973 (3.41)	279 (0.47)
Khamgaon	22,734 (28.79)	27,707 (35.96)	25,091 (31.77)	13,867 (18.00)	2,177 (2.76)	1,749 (2.27)	4,104 (5.20)	6,787 (8.81)	4,071 (5.16)	6,333 (8.22)	5,678 (7.19)	8,933 (11.59)	1,127 (1.43)	791 (1.03)	81 (0.10)	1,191 (1.55)	868 (1.10)	1,404 (1.82)	2,890 (3.56)	283 (0.37)
Mehkar	17,040 (20.82)	9,008 (9.29)	11,516 (14.07)	11,923 (12.30)	2,855 (3.49)	2,934 (3.03)	5,365 (6.55)	6,264 (6.46)	9,213 (11.26)	14,385 (14.84)	12,587 (15.38)	16,421 (16.94)	3,065 (3.74)	4,076 (4.20)	404 (0.49)	1,171 (1.21)	1,141 (1.39)	230 (0.24)	10,507 (12.84)	1,721 (1.78)
Chikhli	18,822 (28.18)	8,363 (7.82)	18,252 (27.32)	12,622 (11.80)	1,403 (2.10)	2,206 (2.06)	2,618 (3.92)	4,693 (4.39)	3,611 (5.41)	8,561 (8.00)	4,025 (6.03)	15,288 (14.29)	713 (1.07)	14,614 (13.66)	102 (0.15)	8,377 (7.83)	753 (1.13)	215 (0.20)	6,969 (10.43)	1,017 (0.95)
Buldhana	15,659 (24.84)	7,296 (10.23)	15,683 (24.88)	11,968 (16.77)	4,034 (6.40)	2,872 (4.03)	3,125 (4.96)	1,183 (1.66)	4,364 (6.92)	4,527 (6.35)	6,332 (10.04)	6,897 (9.67)	1,567 (2.49)	1,120 (1.57)	113 (0.18)	1,926 (2.70)	417 (0.66)	289 (0.41)	1,862 (2.95)	604 (0.85)
Deulgaon Raja	20,328 (28.07)	11,896 (25.76)	19,488 (26.91)	9,906 (21.45)	2,054 (2.84)	1,260 (2.73)	4,152 (5.73)	3,594 (7.78)	2,701 (3.73)	4,094 (8.87)	7,215 (9.96)	5,568 (12.06)	865 (1.19)	1,115 (2.41)	99 (0.14)	1,444 (3.13)	2,130 (2.94)	1,458 (3.16)	8,443 (11.66)	367 (0.79)
Sindkhed Raja	18,524 (30.66)	20,677 (27.57)	19,915 (32.96)	12,573 (16.76)	593 (0.98)	4,727 (6.30)	4,341 (7.19)	2,460 (3.28)	3,545 (5.87)	14,015 (18.69)	2,274 (3.76)	10,855 (14.47)	2,774 (4.59)	712 (0.95)	66 (0.11)	1,359 (1.81)	174 (0.29)	405 (0.54)	4,555 (7.54)	719 (0.96)
Lonar	14,779 (21.96)	6,631 (9.50)	15,388 (22.86)	9,171 (13.13)	2,216 (3.29)	1,353 (1.94)	3,625 (5.39)	18,317 (26.23)	5,308 (7.89)	9,094 (13.02)	7,880 (11.71)	12,398 (17.76)	2,075 (3.08)	1,151 (1.65)	82 (0.12)	658 (0.94)	940 (1.40)	91 (0.13)	8,942 (13.29)	1,284 (1.84)
District Total	**245,640 (30.92)**	**217,650 (25.82)**	**212,920 (26.80)**	**135,940 (16.13)**	**18,320 (2.31)**	**26,240 (3.11)**	**46,441 (5.85)**	**59,180 (7.02)**	**42,620 (5.37)**	**87,280 (10.35)**	**60,809 (7.65)**	**103,830 (12.32)**	**16,920 (2.13)**	**26,290 (3.12)**	**1,580 (0.20)**	**26,080 (3.09)**	**12,120 (1.53)**	**5,960 (0.71)**	**52,560 (6.62)**	**7,308 (0.87)**

Source: Compiled by Researcher

In contrast, Wheat cultivation increased moderately from 18,320 ha (2.31%) to 26,240 ha (3.11%). Higher concentrations of wheat were observed in Sindkhed Raja (6.30%), Motala (5.23%), and Jalgaon (Jamod) (4.46%), mainly because of improved irrigation facilities and the adoption of high-yielding varieties. The increase in wheat indicates the growing importance of irrigated agriculture in selected parts of the district. Pulse crops exhibited remarkable growth during the study period. Tur increased from 46,441 ha (5.85%) to 59,180 ha (7.02%), with the highest concentration recorded in Lonar (26.23%), followed by Khamgaon (8.81%) and Deulgaon Raja (7.78%). Similarly, Mung cultivation expanded significantly from 42,620 ha (5.37%) to 87,280 ha (10.35%), particularly in Sindkhed Raja (18.69%), Mehkar (14.84%), Shegaon (13.86%), Lonar (13.02%), and Jalgaon (Jamod) (12.98%). The area under Other Pulses also increased substantially from 60,809 ha (7.65%) to 103,830 ha (12.32%), with higher concentrations in Lonar (17.76%), Mehkar (16.94%), Chikhli (14.29%), and Sindkhed Raja (14.47%). These changes indicate a growing preference for pulse cultivation because of their drought tolerance, lower production cost, higher market value, and increasing consumer demand. Gram also recorded a moderate increase, rising from 16,920 ha (2.13%) to 26,290 ha (3.12%). The most significant increase occurred in Chikhli, where the share of Gram increased from 1.07 per cent to 13.66 per cent of the gross cropped area. Moderate expansion was also observed in Mehkar and Deulgaon Raja, indicating increasing adoption of Rabi pulse cultivation. Among cereal crops, Maize showed one of the highest growth rates during the study period. The cultivated area increased sharply from 1,580 ha (0.20%) to 26,080 ha (3.09%), with notable expansion in Chikhli (7.83%), Malkapur (4.49%), Sangrampur (4.37%), and Jalgaon (Jamod) (4.26%). The rapid increase reflects the rising demand for maize in the food, livestock feed, and industrial sectors. Conversely, Bajara cultivation declined considerably from 12,120 ha (1.53%) to 5,960 ha (0.71%), with only Deulgaon Raja (3.16%) retaining a relatively larger share. Likewise, Safflower experienced a drastic decline from 52,560 ha (6.62%) to 7,308 ha (0.87%). Earlier, safflower occupied a significant proportion of the cropped area in Mehkar, Chikhli, Deulgaon Raja, and Lonar, but its cultivation reduced sharply across all tehsils during 2010–2015 due to lower profitability, changing market conditions, and replacement by cotton, pulses, and other commercially viable crops.

Conclusion

The present study reveals that the cropping pattern of Buldhana district underwent significant spatio-temporal changes between 1995–2000 and 2010–2015. The cultivation of traditional cereal crops declined, whereas commercial and pulse crops expanded due to changing agricultural practices and economic opportunities. The observed changes indicate a gradual shift towards a more diversified and market-oriented agricultural system. Correlation analysis further shows that population distribution has no statistically significant influence on the cropping pattern, suggesting that physical, technological, and economic factors play a more important role in determining crop distribution. The findings provide valuable insights for sustainable agricultural planning and efficient resource management in the district.

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Conflicts of interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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